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EXAMINER

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte THOMAS R. PUZAK, ALLAN M. HARTSTEIN,
MARK CHARNEY, DAINEL A. PRENER, and PETER H. ODEN

Appeal 2007-0805
Application 09/458,883
Technology Center 2100

Decided: December 19, 2007

Before JOSEPH F. RUGGIERO, LANCE LEONARD BARRY, and
JEAN R. HOMERE, *Administrative Patent Judges*.

BARRY, *Administrative Patent Judge*.

DECISION ON APPEAL

I. STATEMENT OF THE CASE

A Patent Examiner rejected claims 1, 3-12, and 14-22. The Appellants appeal therefrom under 35 U.S.C. § 134(a). We have jurisdiction under 35 U.S.C. § 6(b).

A. INVENTION

1 The invention at issue on appeal involves "prefetching," a technique used to reduce the delays caused by cache misses. Prefetching mechanisms attempt to anticipate which sections of memory will be used by a program and fetch them into a cache before the processor would normally request them. (Spec.¹ 1.) A commonly used prefetching technique involves inserting prefetching instructions, i.e., "touch instructions," into a program. (*Id.* 1-2.) Touch instructions can be used to prefetch instructions or data. For example, a touch instruction can be inserted into a program ahead of an upcoming branch to prefetch instructions located at the target of the branch. Similarly, a touch instruction can be placed ahead of the load instruction to prefetch data into the cache. (*Id.* 2.)

Inaccurate or unsuccessful prefetches should be avoided. (*Id.* 3) Consequently, the Appellants' prefetching mechanism relies on the proven predictability of branches to allow a branch-prediction-mechanism to capture the repetitive nature of an execution path through a program. The mechanism retains data regarding the execution path of a program and supplies this information to the processor. The processor then determines which touch instructions to execute and discards those touch instructions along not-taken paths of a program. (*Id.* 4.)

¹ We rely on and refer to the Specification "with line numbers added" (Substitute App. Br. 1) in lieu of the original Specification, which lacked such numbers.

B. ILLUSTRATIVE CLAIM

Claim 1, which further illustrates the invention, follows.

1. In a system including a high speed buffer logically placed between memory and at least one processor unit, a method for executing an instruction stream stored in the memory, wherein the instruction stream comprises a sequence of instructions including at least one prefetch instruction that prefetches information from the memory into the high speed buffer, the method comprising the steps of:

deriving first path data from a compiler by analyzing control flow information during compilation, wherein the first path data represents a first path from the prefetch instruction to an instruction that uses information prefetched by the prefetch instruction;

obtaining a branch history defining a path from information generated by branches encountered prior to a subsequent encounter of the prefetch instruction;

generating second path data, wherein the second path data represents a predicted second path of execution;

determining whether the first path is consistent with the predicted second path; and

prefetching instructions and data when the first path is consistent with the predicted second path.

C. REJECTION

Claims 1, 3-12, and 14-22 stand rejected under 35 U.S.C. § 103(a) as obvious over U.S. Patent No. 5,742,804 ("Yeh").

II. ISSUE

"Rather than reiterate the positions of parties *in toto*, we focus on an issue therebetween." *Ex parte Kuruoglu*, No. 2007-0666, 2007 WL 2745820, at *2 (BPAI 2007). The Examiner asserts column 6, lines 28-37 of Yeh "specifically mention[s] . . . dynamic branch prediction which indicates obtaining branch history of branches happening long before the prefetch is currently encountered" (Ans. 4.) He further asserts, "Those of ordinary skill in the art recognize dynamic prediction of an execution path involves recording results (or tabulating some prediction value) of branches of previous executions in order to predict the current execution path (i.e. which branches will be taken this time around and which won't; the branch history)." (*Id.* 11-12.) The Appellants argue, "The Examiner has not shown how the branch predictor of Yeh can correspond to the claimed 'branch history.'" (Substitute App. Br.² 5.) Therefore, the issue

² We rely on and refer to the Substitute Appeal Brief, in lieu of the original appeal brief, because the latter was defective. We will not consider the original in deciding this appeal.

is whether the Examiner has shown that Yeh's dynamic branch predictor obtains a branch history defining a path from data generated by branches encountered prior to a subsequent encounter of a prefetch instruction.

"Both anticipation under § 102 and obviousness under § 103 are two-step inquiries. The first step in both analyses is a proper construction of the claims The second step in the analyses requires a comparison of the properly construed claim to the prior art." *Medichem, S.A. v. Rolabo, S.L.*, 353 F.3d 928, 933, (Fed.Cir. 2003) (internal citations omitted).

III. CLAIM CONSTRUCTION

1 Claims 1 and 12 recite in pertinent part the following limitations:
"obtaining a branch history defining a path from information generated by branches encountered prior to a subsequent encounter of the prefetch instruction"

IV1. OBVIOUSNESS ANALYSIS

"In rejecting claims under 35 U.S.C. § 103, the examiner bears the initial burden of presenting a *prima facie* case of obviousness." *In re Rijckaert*, 9 F.3d 1531, 1532 (Fed. Cir. 1993) (citing *In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992)). The question of obviousness is "based on underlying factual determinations including . . . what th[e] prior art teaches explicitly and inherently" *In re Zurko*, 258 F.3d 1379, 1383 (Fed. Cir. 2001) (citing *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966); *In re*

Dembiczak, 175 F.3d 994, 998 (Fed. Cir. 1999); *In re Napier*, 55 F.3d 610, 613 (Fed. Cir. 1995)). "With respect to core factual findings in a determination of patentability . . . the Board cannot simply reach conclusions based on its own understanding or experience-or on its assessment of what would be basic knowledge or common sense. Rather, the Board must point to some concrete evidence in the record in support of these findings." *In re Zurko*, 258 F.3d 1379, 1386 (Fed. Cir. 2001).

Here, the question of whether Yeh's dynamic branch predictor obtains a branch history defining a path from data generated by branches encountered prior to a subsequent encounter of a prefetch instruction constitutes a core factual finding. The part of the reference relied on by the Examiner explains that "[t]he way that [its] cancellation policy is implemented in one embodiment of the present invention is by first predicting (using dynamic and static branch predictors) an execution path of the programmed sequence of instructions, and then comparing the execution path with the trace vector for the branch predict instructions." (Col. 6, ll. 27-32.) It is uncontested that "[t]he entire Yeh patent does not elaborate on specifically what are dynamic branch predictors." (Substitute App. Br. 5.) Furthermore, the Examiner provides no evidence that dynamic branch predictors were known to have obtained a branch history.

Although the Examiner's assertion is far from implausible, without the aforementioned explanation or evidence, we cannot find that Yeh's dynamic

branch predictor obtains a branch history defining a path from data generated by branches encountered prior to a subsequent encounter of a prefetch instruction simply based on the Examiner's assessment of what would be basic knowledge to those of ordinary skill in the art. Rather, we need some concrete evidence in the record to support such a finding. Therefore, we reverse the rejection of claims 1 and 12 and of claims 3-11 and 14-22, which depend therefrom.

V. ORDER

In summary, the rejection of claims 1, 3-12, and 14-22 under § 103(a) is reversed.

REVERSED

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